

TERRA

THE NATURAL HISTORY MAGAZINE OF THE WEST

VOL. 20, NO. 3 / WINTER 1982



MUSEUM ON THE MOVE

All too frequently the sudden loss of a leader signals the beginning of gradual erosion and decay of an otherwise great organization. The sudden resignation of Dr. William B. Lee, Director of the Museum, was a shock to all of us; but through the energies, expertise and dedication of the Museum staff and its various boards, the Museum is not decaying or floundering but going strong.

In recent months we have put together a very exciting exhibit schedule which will take us well into the summer. The first of these, "Minerals, Metals and Man," opened January 19, 1982, and will be on display for approximately four months. A special traveling exhibition from the National Museum of Natural Sciences in Ottawa, Canada, "Minerals, Metals and Man" focuses on man's use of minerals and metals through the ages and is a fitting complement to the Natural History Museum's world-renowned Gem and Mineral Hall.

February 2, 1982 signaled the unveiling of the "Rainbow Gems Collection," an extraordinary collection of 300 natural fancy-colored diamonds valued in excess of \$10 million which are on display in the Hixon Gem Vault. This exciting exhibit contains diamonds cut in a variety of sizes and shapes, averaging about one carat each. They represent the life's work of their owner, Mr. Eddy Elzas-Friedberg of Antwerp, Belgium. The Rainbow Gem Collection has been brought to the Natural History Museum for its premiere appearance on the west coast through the efforts of the Gemological Institute of America.

Beginning March 5, 1982 the Museum will play host to a variety of extinct creatures that once inhabited the planet earth in the form of a special exhibit of paintings, drawings and sculptures by Charles R. Knight who was probably the first and undeniably the foremost artist to recreate, with both a scientific accuracy and romantic beauty, the creatures and environments of prehistoric times. The

exhibit in the Museum's Rotunda will contain approximately 100 of the more than 1,000 pieces created by Charles Knight and will coincide with the release in Los Angeles of a publication illustrating Knight's life and major works, "Dinosaurs, Mammoths and Cavemen: The Art of Charles R. Knight," authored by Sylvia Massey Czerkas and Donald F. Glut.

It should also be mentioned that the Natural History Museum hosted one of the country's most prestigious organizations in December when the Association of Science Museum Directors chose Los Angeles and the Natural History Museum as the site of its annual national conference. Without exception, those in attendance were lavish in their praise of the Museum's facilities, programs and staff. It should even be mentioned that Southern California's Weather Bureau contributed to making their visit a memorable one.

To continue on an upbeat note, planning is well underway for two of the Museum's most popular events. The Alliance Open House takes place this year on Friday, March 19, and we are planning again for a large and enthusiastic turnout. Sunday, June 6, has been set for the Museum's Annual Craft Fair, the theme of which this year is, "The Great Museum Game," in which a game board map and prizes will encourage visitors to explore the mysteries and delights of the Museum, as well as to view the craft demonstrations in a colorful fair atmosphere traditionally held on the broad south lawn in Exposition Park.

Finally, on a much sadder note, I cannot close without mentioning the retirement of Dr. Fred Truxal, Chief Curator of Life Sciences, at the end of February after thirty years of dedicated service to the Museum. Over these years Fred has become a friend and confidant of many of us connected with the Museum, and his retirement will be a considerable personal and professional loss to us all. Happily, in retirement Fred plans to continue his association with the Museum in a volunteer research capacity as Chief Curator Emeritus.

Leon G. Arnold
Acting Director

FRED TRUXAL RETIRES

Dr. Fred S. Truxal is retiring early from the Natural History Museum after thirty years of service. When he graduated as a Ph.D. in 1952 from the University of Kansas, Truxal's main interest was a career in teaching. But there were few opportunities for entomologists in that profession and when the Los Angeles position as Curator of Entomology was offered him, he grabbed it. Then, in 1957, he received the best of two worlds, an adjunct professorship in entomology at the University of Southern California. He taught

actively for five years, and since that time has continued on curriculum committees and participated in various affairs of the University. His active teaching was cut short by his appointment in 1961 as Chief Curator, Life Sciences Division, at the Museum.

He has enhanced that Division by adding several more disciplines in Life Sciences and making it a more balanced department. The added sections are archeology, herpetology, and malacology. In addition, Truxal has been instrumental in adding to the professionalism of the Life

(Continued on Page 31)

TERRA

THE MEMBERS MAGAZINE OF
THE NATURAL HISTORY MUSEUM ALLIANCE
OF LOS ANGELES COUNTY
VOL. 20, NO. 3, WINTER 1982



CONTENTS

DINOSAURS, MAMMOTHS,
AND CAVEMEN
by Sylvia Massey Czerkas
and Donald F. Glut 3

THE QUEEN'S
WATER LILY AND
THE CRYSTAL PALACE
by William A. Emboden 12

ROSE O'NEILL'S BABY
by Elizabeth J. Wright 19

ADOBE!
by Robert Nicolais 23

COVER

"Tyrannosaurus Rex" The morning light, touching the very tops of the trees and illuminating the giant head of the Tyrannosaur, makes this a truly dramatic painting. Unfortunately, this piece is missing from our museum collection and any information as to its whereabouts would be appreciated.

EDITOR

Dorothy H. Seligman

ASSOCIATE EDITORS

Kilbee Brittain/Harry Pack

CONTRIBUTING EDITORS

William A. Emboden Jr./Gretchen Sibley/
Edward Wilson

DESIGN DIRECTORS

Armin Krumbach, Harry J. Pack

EDITORIAL ASSOCIATES

Sage Belt/Jane Dart/Hailey Dart/
Jeanne Duque/Mary P. Goodwin/Glenn Hiatt/
Pat Herbert/Hannah Kully/William B. Lee/
Richard Lipscomb/Genie Paul/Ralph
Schreiber/Jean Stone/Robert Spangenberg/
Donna Tuttle/Elizabeth Wright

MUSEUM PHOTOGRAPHERS

Dick Meier/John DeLeon

STAFF ILLUSTRATORS

Mary Butler/Joseph Nakanishi

Printed by North Hollywood Printing Co., Inc.

Color separations by Computer Color Corp.

Typography by RSTypographics

All Rights Reserved. Reproduction in whole or
in part without permission is prohibited.

DINOSAURS, MAMMOTHS, AND CAVEMEN

The Art of Charles R. Knight

by SYLVIA MASSEY CZERKAS
and DONALD F. GLUT



Charles Knight in his New York Central Park West studio about 1907 is surrounded by the skins he studied to impart realism to his paintings. (Courtesy of the American Museum of Natural History)

Charles R. Knight gave to the modern world his visions of its own prehistory, re-creating in all the numerous art mediums he commanded roughly one thousand drawings, paintings, and sculptures of ancient animals and men. Before Knight, there were but fossils and fanciful impressions of what those ancient remains represented.

"Dimetrodon" The spines of the vertebrae developed into a strange fin like sail on this carnivorous Permian reptile.



"Stegosaurus" This peculiar armored dinosaur of the Jurassic had two rows of triangular dorsal plates and four tail spikes. Contained in the length of this twenty foot dinosaur was a brain the size of a walnut.



But Knight, through his own vision of that world never before seen, bequeathed to us our own visions of prehistoric animals and primitive men. That the vision provided was one of scientific accuracy and great beauty, happened because of that rare combination of talent and life circumstances.

Knight was born in Brooklyn in 1874, to Lucy and George Wakefield Knight. From his early childhood Knight's parents instilled in their young son an interest in and love of nature. Charles was only five

years old when his father first took him to the American Museum of Natural History, but even at that age he was aware that there could be an artistic approach to presenting animal life to the public and had already discovered in himself an intense interest in drawing. He attended Froebel Academy where he began his formal art education, taking classes in drawing, map-making, and clay and sand modeling in addition to more academic subjects. Knight later enrolled at the Metropolitan Art School where most of the

students were older than himself. He became skilled in watercolor, pencil, charcoal, crayon and oil, and utilized those skills when, at the age of sixteen, he was hired by a church decorating firm to draw animals and plants for stained glass windows.

Knight suffered an emotional collapse following the death of his father in 1892, but the following year he resumed his career as a freelance professional illustrator in New York. As his reputation for doing animal artwork grew, Knight spent



"Brontosaurus" This is the junior synonym for the dinosaur now known as Apatosaurus. It was a gigantic sauropod of the Jurassic period.



"Pteranodon" This crested pterosaur with a 27 foot wingspan glided over the ancient seas in search of food.

more and more time at the Central Park Zoo studying his beloved living models. He carried his personal studies over to the American Museum of Natural History where, visiting the museum on an almost daily schedule, he studied the carcasses of various creatures, meticulously familiarizing himself with their musculature and skeletal structure. Often the carcasses were foul smelling but this first-hand course in animal anatomy would lay the foundation for the next phase of his career.

Knight's name soon became known to the scientists at the museum. As an amateur scientist, always anxious to learn more about the animals that he drew, Knight soon met many of the staff scientists who, impressed by his desire to learn, offered him continued advice and encouragement. One of Knight's closest friends at the museum was head taxidermist John Rowley who, one day in 1894, told Knight that Dr. Jacob Wortman in the fossil department was looking for someone to make a drawing of *Elotherium*,

an extinct pig-like animal. At Rowley's suggestion, Knight offered his services. Knowing something about modern pigs, Knight studied the skeletal remains of *Elotherium*, applied to those ancient bones his educated estimate of its musculature and attitudes, then made a restoration that both satisfied and delighted Wortman. Soon Wortman was giving Knight more assignments, inadvertently directing him into a field of work that would occupy most of his time for the next four decades.



"Archaeopteryx" A creature having characteristics of both birds and reptiles which may actually be more closely related to small dinosaurs than birds.

In 1896, Knight made one of the most important contacts of his life, Henry Fairfield Osborn—a distinguished scientist who had just taken a position at the American Museum and was later to found its Department of Vertebrate Paleontology. When Osborn first came to the museum, its fossil collection was meager and much of it lay on shelves in the workshops, seen only by workers who cared little about the interests of the general public. Osborn promptly recognized Knight's talents and took the young artist

under his wing. He revealed to Knight his dream of luring the laymen into the museum's halls by making the fossil exhibits both visually informative and exciting.

About this time Knight also met William Diller Matthew, a Canadian scientist who had recently joined the American Museum staff. Knight later wrote that Matthew "for years was my chief consultant and advisor on matters of pose and difficult bone structure, and what unusual forms might indicate in the living animal." Like Knight, Matthew

soon shared Osborn's dream.

Osborn arranged for the museum to acquire more fossil vertebrate skeletons and the galleries housing the new exhibits resounded with the noise of the preparators' scrapers, mallets and drills. The trio of Osborn, Knight and Matthew endeavored to have the fossil skeletons mounted in lifelike poses, a revolutionary concept for the period. One staff member, Chief Preparator Adolph Hermann, thought that fossil specimens were for study and not for the edification of the



"Neanderthal Man Confronting a Timber Wolf" Knight regarded the life of early man as a "constant struggle to maintain himself in an inhospitable world."

public. Hermann, whose idea of mounting a skeleton was simply to string the vertebral column along a straight length of steel rod, was, not surprisingly, opposed to the new ideas of the Osborn-Knight-Matthew team. But he soon acquiesced, as did others at museums around the world which began to imitate the new techniques.

To achieve the remarkable realism displayed even in his earliest prehistoric restorations, Knight first studied the bones of the extinct creature. His goal was not

simply to restore an animal never seen by modern man but to infuse it with life. Therefore, he applied the knowledge he had garnered from studying living animals, his philosophy being that no one can paint an animal that is "dead" before being able to paint one that is alive. Then, after questioning Osborn or Matthew about the possible habits and appearance of the animal, he extrapolated what he knew of present-day animal physiology and psychology and gave life to the ancient bones.

Once he had a fairly accurate conception of the extinct creature in his mind, he would make a miniature sculpture of the animal so that he could take note of the shadows that it might cast on the ground in sunlight. Sculpting was relatively new to the artist, who mastered the technique so that he would have a three dimensional model from which to make his painting.

Life restorations of prehistoric animals were rarities in 1896, most paleontologists being content to study disarticulated



"Woolly Mammoth" These impressive animals were the source of both food and inspiration for Cro-Magnon man who adorned the walls of his cave with paintings of the creature and also hunted it.

fossil bones rather than see some hypothetical re-creation of the animal in the flesh. But Osborn was, through Knight's skills, doing his best to change such thinking. By the Spring of 1898 Osborn managed to bring some small aspect of the American Museum outside its walls and directly to the public through a catalog of models, casts, and photographs of restorations of fossil vertebrates, that could be purchased by interested parties. Osborn hoped that the items would help spread information about extinct creatures to interested non-scientists. Later,

through a survey conducted by staff members of the museum's Department of Vertebrate Paleontology, it was recognized that, to museum visitors, the most meaningful fossil exhibits were those accompanied by Knight's watercolor life restorations.

Gradually Knight was assuming celebrity status at the American Museum of Natural History. Where earlier he had largely based his works on the mounted skeletons on display in the galleries, now newly acquired specimens were being set up to mimic the poses in his restorations.

Inadvertently the artist had entered the realm of prehistoric animal art only to emerge, a short while later, as its premier creator. The world was rapidly coming to acknowledge that, when it came to restoring extinct creatures, Knight was the best.

These factors undoubtedly influenced William Alanson Bryan, first Director of the Los Angeles County Museum of History, Science, and Art, when, in 1925, he invited Knight to paint a mural for the new gallery housing fossils from the famous Rancho La Brea "tar pits." Bryan



"Dodos" These fifty pound and flightless birds have become the symbol of extinction. They are portrayed here as a tranquil family group.

offered Knight a fee of \$5,000 to come to Los Angeles to paint a mural depicting Hancock Park in the late Pleistocene with restorations of fossil animals from the tar pits.

Bryan's letter August 1, 1925:

"While I had supposed that you would care to use the general material made use of by you in preparing the canvas for the American Museum, it was my hope to include in our canvas...practically all of the

larger and more spectacular animals recovered from the pit; without attempting to arrange the composition, I felt we could show the tar trap pools, the Santa Monica Mountains in the distance and distribute about the area the Saber-Tooth tiger, the Elephant, the Mastodon, the La Brea Lion, the Coyote, both species of Sloth, the Camel and Horse, the Bison and Extinct Antelope, as well as one or two species of the extinct forms of birds. Some of the material for this study I believe is only represented by

material in the museum, so I hope that you will be able to arrange to do the work here where it can be discussed in progress."

By this time, however, Knight felt far more comfortable creating in his own surroundings and ventured out of his studio as infrequently as possible.

After a long series of communications with Bryan, during which Knight repeatedly made excuses to defer traveling to California, Knight finally began work on the Los Angeles mural — but in the



"The La Brea Mural" In 1769, the Spanish explorer Gaspar de Portola cited "springs of pitch" at Rancho la Brea in California. More than a century later, in March, 1906, scientific excavations began at the site. This deposit has yielded the greatest number of Pleistocene fossils in the world. Knight painted the magnificent fifty foot La Brea mural for the Los Angeles museum in 1925 depicting animals indigenous to the area during the Pleistocene.



comfortable atmosphere of his own New York studio. Knight promised to have the painting finished and ready for installation by the museum's opening day of November 3rd, after which he would venture to the west coast and add the final touches to the piece. When the artist was informed that the opening day had been delayed, he completed the mural at his own studio. With Osborn's approval and endorsement, Knight then shipped the work to the Los Angeles museum.

The Los Angeles La Brea mural was one of three, though arguably the best, that Knight devoted to this topic; the other two were completed for the American

Museum and the Field Museum of Chicago. Knight succeeded in capturing the dramatic late Pleistocene scene and in depicting the wide range of contemporary life without unduly crowding his canvas. Unfortunately, the mural has never previously been seen to its best advantage; it was painted to be viewed from below but has since its arrival been displayed at ground level in the California Fossils Hall. Although now fragile, after the Charles Knight exhibit ("Dinosaurs, Mammoths and Cavemen" — the art of Charles Knight; March 5th–May 30th, 1982") the mural will be restored and replaced high on the wall of the main foyer,

which will help bring out the three dimensional perspective of the painting.

Dr. William Akersten, Curator of La Brea fossils, points out—"given the fact that the mural was completed 57 years ago, Knight's La Brea scene is remarkably close to that which we could reconstruct today after subsequent decades of careful scientific investigation."

From 1944 to 1946, Knight produced what was to become his final series of paintings, representing different forms of life through geological time. In all, the series comprised twenty-four small oil paintings, that ranged in scope from trilobites to *Tyrannosaurus* and from moas to

man. These were purchased by the Marcia Brady Tucker Foundation for donation to the Los Angeles Natural History Museum in February 1953. They have subsequently proved a great attraction for visitors whenever they have been put on display.

Edwin H. Colbert, the great paleontologist and a friend of the artist, had this to say about him: "In this very special field of artistic endeavor he was truly a pioneer. He pointed the way for younger artists, and although some of his successors have created superb restorations of ancient life, none has excelled him. Knight not only made us familiar with

the outward form of the animals he was drawing, but also with their inner characters as well. He was able to show us something of the psychology of those early beasts because he knew so well the psychology of their modern relatives which he had so carefully studied. With his skills Charles Knight opened our eyes to a former world, much of it never seen by man."

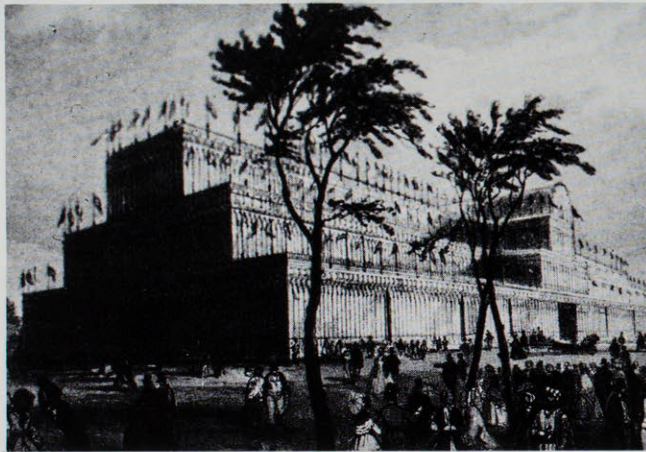
Sylvia Massey Czerkas is an artist whose work has been shown in galleries and museums throughout America including the Natural History Museum of Los Angeles County. Her

subject matter spans the entire animal kingdom with a special emphasis on dinosaurs. She is the founder of "The Dinosaur Society" and a member of the "Society of Vertebrate Paleontology."

Donald F. Glut has authored more than thirty books, both fiction and non-fiction. These include the novelization of the movie "The Empire Strikes Back" and such non-fiction books as "The Dinosaur Dictionary," "The Dinosaur Scrapbook" and "The Frankenstein Catalogue." He is a member of the "Society of Vertebrate Paleontology" and "The Dinosaur Society."



AND THE CRYSTAL PALACE



Color lithograph of the Crystal
Palace by Brandard, 1851.

by WILLIAM EMBODEN

"Victoria has shown flower!"

Joseph Paxton, gardener, to the Duke of Devonshire. 1849

There are only a few discoveries in the history of botany that have been truly startling. One such event was the finding of a water lily of gigantic proportions in the Amazon in 1837. It was in that year that the young Victoria ascended to the throne of Great Britain, and it was her name that was given to the mammoth plant.

This narrative chronicles a series of amusing and intriguing events that document the relationship between a duke,

his protégé, an explorer and a queen. It also traces the emergence of principles drawn from the leaf structure of that bizarre vegetable production, *Victoria regia*, that were to establish the architecture of the great Crystal Palace built for the 1851 Great Exhibition in London.

In 1837 Robert Schomburgk, explorer for the Royal Geographical Society, was in British Guiana "contending with the difficulties that Nature imposed in different forms." It was the first day of January and the intrepid explorer directed his paddlers to fight their way up the river against the current. Finally the crew reached a currentless basin and the boat paused. On the southern extremity some-

thing on the surface of the water caught the explorer's attention. It was disproportionate to all that was around it.

"It was impossible to form any idea of what it could be, and animating the crew to increase their rate of paddling, we were shortly afterwards opposite the object which had aroused my curiosity—a vegetable wonder! All calamities were forgotten. I felt as a botanist, and felt myself rewarded. A gigantic leaf from five to six feet in diameter, salver shaped with a broad rim of light green above, and a vivid crimson below, was resting upon the water."

Schomburgk gazed in total rapture and astonishment at this enormous creation. Its flowers, each of hundreds of petals,

floated on the smooth surface of the water like so many gigantic roses centered with innumerable protruding yellow stamens. Schomburgk had his men paddle him about through this unearthly water garden, his glance darting from the orbicular leaves to the melon-size flowers. He noted that the rim of the leaves turned up like a quiche crust to a height of three to five inches. The strong, hollow ribs radiated out from the central peltate petiole, and were armed with strong spiny enations. The ribs were two inches in thickness near the petiole. As they radiated outwards, cross veins kept the midribs from buckling. Young Indians of this area used the boat-like pads to support themselves while spearing fish.

All of this he recorded in his volume entitled *A Description of British Guiana*. Schomburgk was unaware that the plant that he reported upon had been discovered in 1801, but without any significant botanical description. It was appropriate that this beautiful water lily be named for the Queen of England who in that year inherited the throne.

It is an astonishing fact that it was a full nine years before the Royal Botanical Gardens in Kew (Richmond, Surrey) got any seeds from the freshwater giant. The seedlings germinated and produced some juvenile foliage in the stovehouses at the Royal Gardens, but these diminutive pads were a far cry from the extravagant leaves described by Sir Robert Schomburgk.

An ambitious lad by the name of Joseph Paxton had become protégé to the Duke of Devonshire, who was an avid horticulturalist. The Duke had entrusted the design and building of several stovehouses on his properties in Derbyshire to Paxton. In July of 1849 he wrote his friend Sir William Hooker, then at Kew, that he was building a special tank for the water lily at Chatsworth. The willingness of Hooker to part with the plant may have been related to the problems inherent in having named it for the young Queen. If it were not to flower this would be a great embarrassment to all.

Upon returning from a trip to Scotland, Paxton went to Kew to oversee personally the removal and transport of the water lily. It was lifted from its muddy environs with great care and then crated. By carriage it went to Euston Station in London, where it was put on a train to Blakewell, and thence to the Duke's estate at Chatsworth. No one would have guessed that the box held one of the strangest plants ever seen in the British Empire.

Joseph Paxton had been made head gardener by the Sixth Duke of Devonshire in 1826 when he was twenty-five, and still very inexperienced. Within a short time he had become manager of all of the Duke's affairs and his influence extended to several other Devonshire estates. It was said of him that his authority was as great as that of the Duke's solicitor.

Under the Duke's patronage Paxton

was provided travel to Paris, Versailles, and numerous cities in Switzerland, Italy, Greece, Turkey, Germany, Austria and Malta. This, in part, helped to compensate for the lack of a formal education. Beyond this extravagance, it was the Duke who made it possible for Paxton to produce his own botanical magazine from 1834 through 1849. The exquisite hand-colored, engraved plates of these volumes represented many of the first illustrations of new horticultural introductions into England.

On his trips abroad Paxton studied the architecture of Europe, especially the glass houses or "stovehouses," which we today call greenhouses. Back in England he was soon engaged in building a series of variations on these at Chatsworth. The "Great Conservatory" was completed in 1843, and was so spectacular that Queen Victoria, Prince Albert, and the Duke of Wellington journeyed to Chatsworth to see the edifice. The great dome was illuminated with 12,000 gas lamps and was heated by eight large boilers beneath it. The design allowed the Queen and her party to drive through it without leaving her carriage.

In August of 1849 Paxton had commenced his work on the *Victoria regia* house of web-like cantilevers that touched intermittently and yet were capable of withstanding great weight. The glass and wood roofing was the simplest, lightest, strongest and most elegant yet seen in England. The whole thing was completed by the early Spring of 1850. It had a heated pool filled with five loads of richly composted soil. Gas lights warmed the air and lighted the place. Miles of piping carried heat throughout the house while remaining out of sight. A small paddle wheel kept the water moving gently. Visitors could promenade on decks above and around the marvel and tropical vines and banana trees completed the exotic effect. While giant rocks, birds, and fish helped to make the mise-en-scene spectacular, it was *Victoria regia* in full radiant bloom that arrested every eye.

The Queen's water lily had almost covered the pond with its leaves in two months of growth. Each leaf reached four to five feet across, much as they would have in nature. The Duke was in Ireland when this wonder child of tropical waters began to develop. He insisted that Paxton must write him a daily progress report on *Victoria regia*. In November the leaves had exceeded ten feet in circumference and flower buds were making their appearance.

In his retreat in Lismore Castle, Ireland, the Duke received a letter stating, "*Victoria* has shown flower! An enormous bud like a poppy head made its appearance yesterday. It looks like a large peach placed in a cup. No words can describe the beauty of the plant."

Soon more buds were evident and the

news was out. The horticultural world received this announcement by Paxton: "The lily is worth coming thousands of miles to see." The Duke had already dispatched himself to Chatsworth to witness the florescence.

On November 13, Her Royal Majesty sent for Paxton and instructed him to bring a flower and one leaf to Windsor Castle. She noted laconically, "We were immensely pleased."

Botanists from throughout the world beat a path to Paxton's water lily pond and stovehouse whose delicate but strong architecture Paxton claimed to have derived from a study of the very leaf of *Victoria regia*. Sir William Hooker and Dr. John Lindley of Kew came to admire the specimen. Paxton had accomplished at Chatsworth a feat that they were unable to perform at Kew.

The Illustrated London News of November 17, 1849 carried a story about the giant water lily from South America, and published a wood engraving showing Annie, Paxton's daughter, standing on one of the leaves. Annie was only seven years old, but weighed a hefty one hundred pounds. The event was commemorated in verses by Douglas Jerrold:

"on unbent leaf in fairy guise,
Reflected in the water,
Beloved, admired by hearts and
eyes,
Stands Annie, Paxton's daughter."

The verses have a certain humor in light of the rather plump "fairy" perched upon the leaf in her crinolines.

Newspaper accounts reached that intrepid explorer of the Himalayas, Sir Joseph Hooker, who had found the newspaper story "incredulous" and wrote to Paxton to ask for his personal verification of this assertion. Even botanists were stunned by these reports.

It was in that same year that Prince Albert was tortured by the idea that an architect would have to be found who could build a grander and more imposing edifice than that which housed the 1849 Paris International Exposition. To this end he appointed a twenty-four member Royal Commission to find a suitable architect and guarantors for an exposition in London in 1851. The Prince himself would head the Royal Commission and among its members he appointed Joseph Paxton. Although Joseph was not a statesman, was lacking an education, was untitled, and had no training in commerce or architecture, his glass houses had won him the favor of Her Majesty as well as the Prince himself.

The Commission decided upon Hyde Park as a site for the building. Sixteen of the twenty acres of verdant park between Knightsbridge Barracks and the Serpentine would be utilized. Albert had previously suggested Leicester Square, but the Commission pointed out that the site had been occupied for some years by a number of prominent buildings. The



Victoria regia

Photo: C. Davidson

Commission undertook to produce a joint design. The predictable results were a monstrosity that would have required nineteen million bricks and would have had a volume four times that of Westminster Abbey. It had the unhappy aspect of a train station hybridized with a cathedral. The designs were published in several London newspapers and were immediately denounced by the public for reason of the horrendous architecture as well as the confiscation of their beloved Hyde Park and its grand trees.

While the Commission conferred, struggled with, and turned down hundreds of plans submitted to them, Paxton was involved with the controversial architect Isambard Kingdom Brunel who had built the elegant suspension bridge at Clifton (and who had less success in building tunnels, which had collapsed). Paxton subscribed to the idea of an exhibition building that would have the airy elements of his glass houses and the strength of Brunel's suspension bridge. Realizing that the public would not tolerate the loss of their great elm trees, he formulated the idea of building over and around the trees. This would necessitate the use of glass in vast amounts and frames of these that were of giant proportion. Brunel pointed out that his bridges were a success because they were easily assembled from numerous interchangeable parts and that a similar scheme could be developed for an exposition building. There were only seven months to complete the construction. While riding on a train, Paxton reflected upon his conversations with Brunel, and upon the architecture of his water lily house that had been derived from the strengths revealed by the architecture of the leaf of *Victoria regia*. He quickly sketched an idea on blotting paper on June 11, 1850 during a

committee meeting of the Midland Railway and took it to the Commission. The idea met with some opposition. Going over the heads of the Commission he took his plans to the public by publishing them in the *Illustrated London News* for July 6, 1850.

His idea was to build a palace of glittering panes of glass and to house the trees in giant transepts at the terminus of the building. It would be entirely modular and he had already found a firm that would manufacture sheets of glass four feet in diameter, larger than any previously manufactured in England. The idea of a crystal palace enchanted the public and the Commission was all but obliged to accept his plans.

On July 26, 1850 the contract was given to Fox and Henderson. The sum of 79,800 pounds seems incredibly slight for such a grand project. Only by taking into account the small salary of laborers can one envision such a vast undertaking for a pittance.

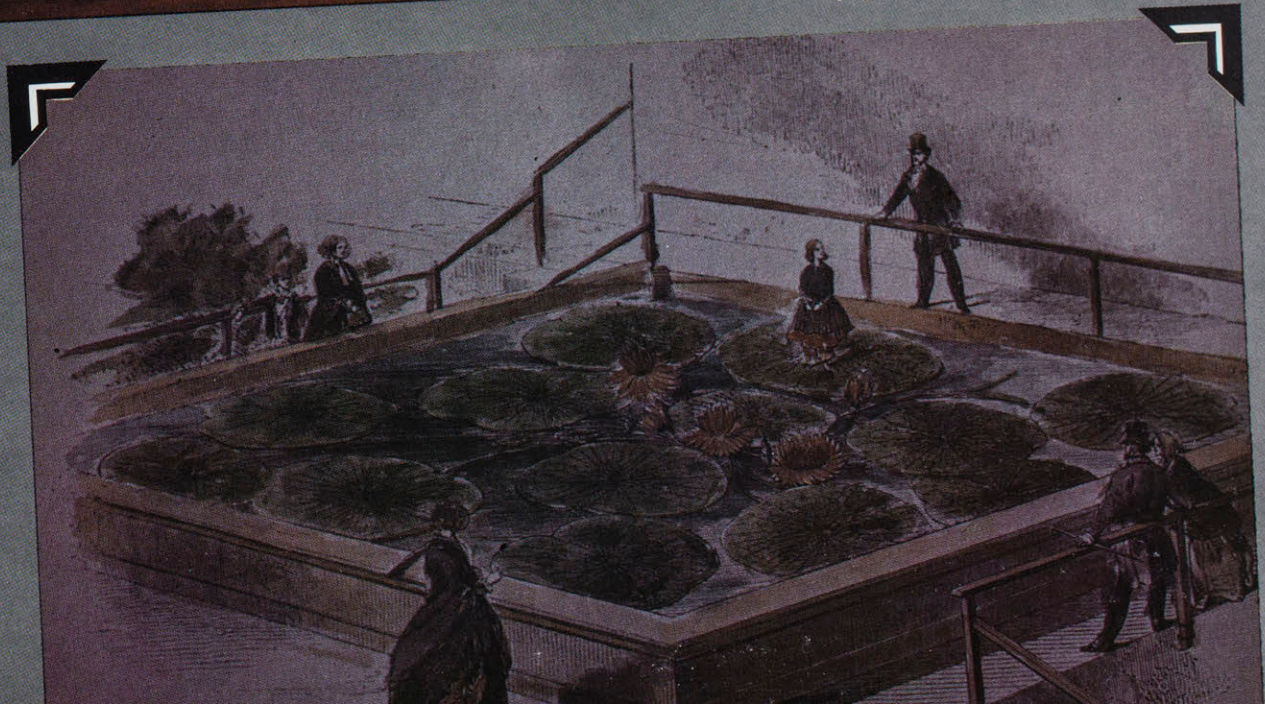
The first installation of a support was made on September 26, and from that point forward the work was continued day and night employing 2,000 workmen. The laying of sashbars and gutters and subsequent glazing was done just as it had been in greenhouses all over England. The modular units of iron did not exceed one ton, and could be moved about with comparative ease. The giant panes of glass were slipped into place like so many shingles on a roof. It is easy to imagine that the Great Crystal Palace, as it was dubbed, was a triumph of architecture and engineering. Nothing comparable had been seen anywhere in the world. It consumed nineteen acres and was three times the size of St. Peter's Basilica in Rome, and four times the size of St. Paul's Cathedral in London.



Paxton presenting his plan for the Crystal Palace to Prince Albert

Queen Victoria and her family at the opening of the Crystal Palace. Detail from a painting by H. C. Selous

Victoria regia with Annie Paxton on a leaf (from the Illustrated London News)



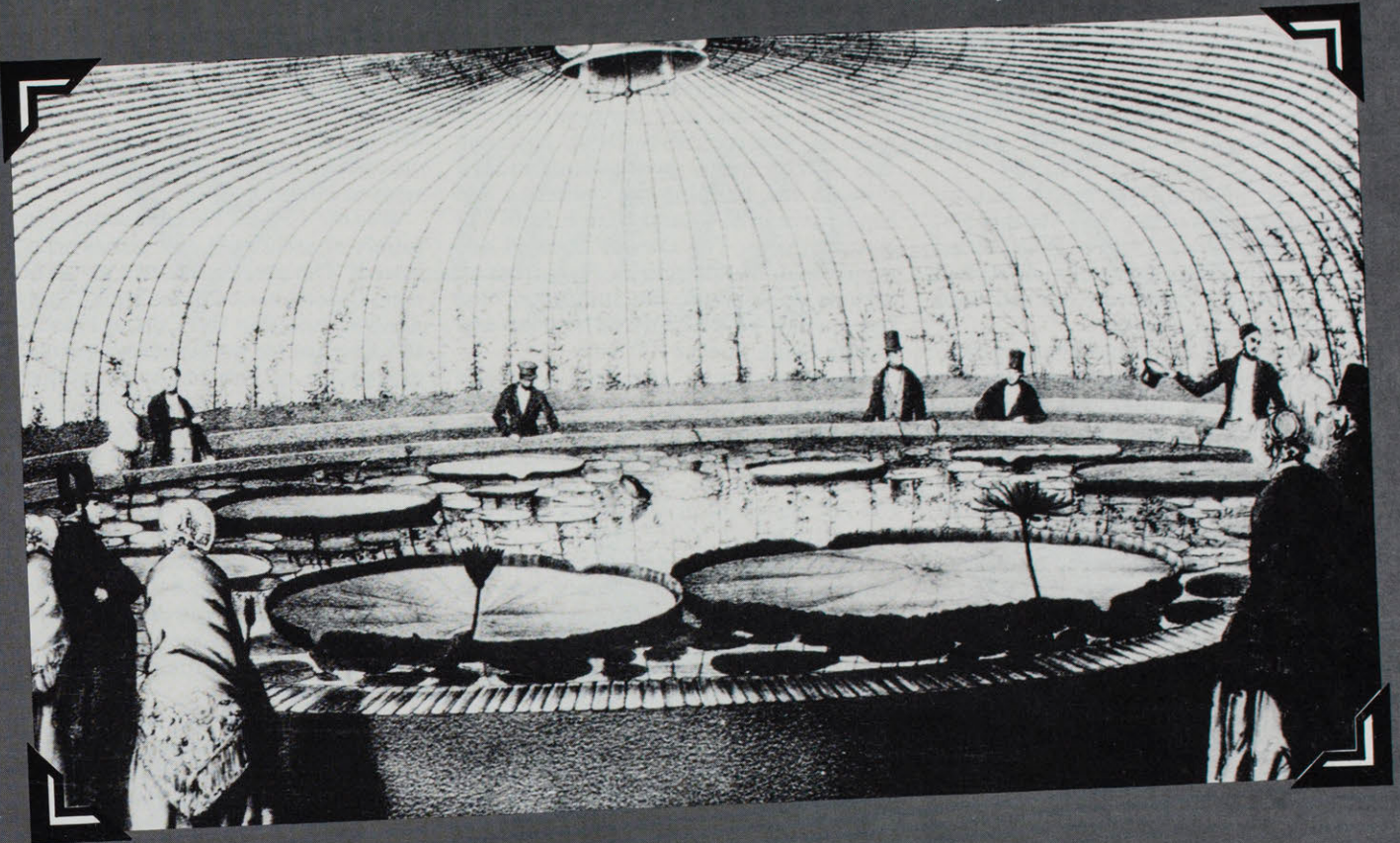


Painting of Joseph Paxton circa 1855

Initial construction of the transepts over the elm tree



Interior of Paxton's Waterlily house at Chatsworth. Note the ribs which correspond to those of the leaf of *Victoria regia*.



Wood engraving of the interior of the Crystal Palace on the day of its closing, from the Illustrated London News

Paxton had not missed a thing. There were louvers for proper ventilation; ugly iron beams were painted a luminous blue to blend with the sky; gutter rails on the roof allowed workers to make any repairs necessary by utilizing small cars on rails. The edifice was impervious to rain and hail and to test its general strength (some had suggested that it would certainly collapse on the day of its opening) Paxton had the Royal Armed Forces march through it en masse. It held steady.

The triumph was Paxton's but he graciously gave it over to Her Majesty and his illustrious Prince Albert. When asked for the source of his inspiration he replied that it was an architecture derived from the leaf of *Victoria regia*.

Detractors like Colonel Sibthorp who had predicted that it would be "dashed to pieces" and the numerous bitter architects who had lost the competition were compelled to admire the building. Wry humorists suggested that in the next generations London's children would be raised in its confines "like so many cucumbers." Punch produced a series of cartoons poking fun at the building, but it proved an enormous success. Its million or more square feet of glass covered exhibitions of all sorts from every area of the world including art, commerce, agriculture, machinery, textiles etc.

Lord Redsdale praised the Great Crystal Palace as "a great conception nobly carried out." Disraeli called it "the enchanted pile" and attributed it to "the sagacious taste of our enlightened Prince."

Three large elm trees growing north to south in the park were housed by an immense wooden transept giving the interior an extraordinary character. However, these were the nesting places for the charming English sparrows whose excrement might spoil the ethereal charm of the interior where ginger beer and raspberry vinegar would be consumed with bread, cheeses and savory pies.

The Queen was advised that the sparrows refused to leave their favorite trees. It was she who suggested that Lord John Russell might best solve the problem. His solution was to call in the Royal Regiment to shoot the sparrows. Prince Albert was quick to point out that this shot would destroy the glass. He suggested birdlime be placed on all of the branches. It was a most ingenious solution, but the birds left the branches to nest in the girders. In quiet desperation the Duke of Wellington was summoned to Buckingham Palace. His solution was to order a quantity of sparrow hawks and to release them inside of the Crystal Palace. According to the memoirs of Lyon Playfair, the birds congregated in a tree nearest to the door, and as soon as "the advice of sparrow hawks was communicated they flew in a body out the door."

When the day of the opening came, May 1, 1851, Victoria, Albert, Vickie and

Bertie all arrived in full regalia. Victoria recorded in her journals that she was deeply moved by the magic and impressive sight. A fanfare of trumpets greeted her as she entered. Refusing to sit on a prepared throne, Victoria stood and admired "that admirable pile" while 1,200 voices sang Handel's Hallelujah Chorus. "The Queen's weather," the crowd murmured as the dull grey sky gave way to a burst of sunlight. Everything glittered, and as the Royal procession walked through the building the orchestra and band played the Grand March from the opera *Athalie*. The crowds cheered and waved their handkerchiefs. Flags from all nations flew above the luminous blue framework picked out in scarlet and orange rising to over 100 feet.

Before this Great Exhibition of Art and Modernism closed on October 15, 1851, over six million visitors had been accommodated. The Prince was vindicated, the Queen was ecstatic, and Joseph Paxton felt the glory of a triumph that was unparalleled.

It may seem curious to the present generation, but the Crystal Palace was the



Victoria regia photographed in the Kew Gardens conservatory (Photo W. Emboden)

first edifice established for large scale functions that had retiring rooms for eating, smoking and drinking, and even ... lavatories! Considering that almost 70,000 people attended the building in a single day it would seem that such amenities were necessities.

Although Joseph Paxton had been summoned to Windsor to present the giant water lily and its leaf to the Queen, few who wandered through the light and colorful Crystal Palace had the remotest idea that it was built by a man who had no formal training in architecture, and whose ideas derived from an analysis of the anatomy and morphology of the giant water lily leaf. For his ingenuity Joseph was knighted, and the Queen commented that it was exemplary that a lowly gardener in her realm could rise to the status of a knight. As Sir Joseph Paxton, he addressed the Royal Society on the subject of art, taking as his prime example the illustrious *Victoria regia* that had generated the most impressive monument in iron and glass ever erected. From this point forward, "ferrous-vitreous architecture" became a common expression.

The fate of the Crystal Palace was widely discussed. It had long been the plan of the Royal Family to give Hyde Park back to the people of London. In less than a year after its closing the London Bright and South Coast Railway bought the building for almost twice the cost of its original construction. It was rapidly reassembled at Sydenham in south east London where it became a popular auditorium for brass bands and giant oratorios until it was completely destroyed by fire in 1936.

Was the Crystal Palace a success in the minds of architects and critics who followed? The great authority on architecture, Gideon, stated in his book *Time and Architecture* that the Crystal Palace was the first use of prefabricated parts on a grand scale, and further he noted that the building had no precedent in architecture. No building of such a colossal scale had been erected in so short a time. For the mid-nineteenth century mind, it was a "romantic" edifice, as the use of so much light and color was totally alien to architecture of the period. It would be another half a century before Eiffel would create his famous tower of iron, before Guimard and Horta would employ these same principles in their lacy constructions of iron.

It was not until the 1930's that "functionalist" architects reevaluated the "water lily principles" of Joseph Paxton and put them to use in the creation of vast frameworks in cities such as New York. The concept of modular units and major areas of glass shaped much of contemporary architecture, and only recently have architects had the daring to bring color back into their buildings.

What nature had created in the still waters of the Amazon was to evolve into forms then undreamed of. *Victoria regia* was immortalized in many subsequent buildings of iron and glass, but none so astonishing as the Crystal Palace.

Post Scriptus: Subsequent to the blossoming of *Victoria regia* at Chatsworth, the Royal Botanical Gardens at Kew have regularly forced their specimen into bloom. It was there that I was able to photograph the plant.

Related Reading:

The Works of Sir Joseph Paxton, George F. Chadwick. The Architectural Press, London. 1961.

Paxton and the Bachelor Duke, Violet Markham. 1935

William Emboden is a Professor of Biology at California State University, Northridge, and is Research Associate in Botany at the Natural History Museum of Los Angeles County. He is also a Research Fellow at the Botanical Museum of Harvard University. He has written a series of articles on artists and architects whose works are derived from the study of plant forms.

ROSE O'NEILL'S BABY

by ELIZABETH J. WRIGHT



Rose O'Neill?
"The world's greatest illustrator," said famed artist Thomas Hart Benton.

"For sheer lyrical utterances she is matched by none of our poets," Clement Woods asserted in his *Poets of America*.

"Her paintings are mysterious and revealing, exalted and terrifying," enthused French art critic Arsene Alexander of O'Neill's 1921 one-woman show at the Beaux Arts Gallerie in Paris.

In the 1920 Ziegfeld Midnight Frolic, Fannie Brice introduced "Rose of Washington Square," a song written for Rose O'Neill.

The Washington Square apartment of this multi-talented woman, the highest-paid magazine illustrator of her time, teemed with New York celebrities: writers, actors, poets and artists. Yet against this background of charismatic, turn-of-the-century greats, columnist O. O.

McIntyre confessed: "The woman who interests me most as a personality is Rose O'Neill."

In spite of her Bohemian life style which included two marriages, world travels, international recognition as a poet, novelist, painter, sculptor and illustrator, Rose O'Neill is best remembered today in American popular culture as "The Mother of the Kewpie."

How did the Kewpie, that enduring paragon of seemingly endless cheer and interminable joy, originate with this early-liberated, sophisticated woman?

It happened in 1908 at Bonniebrooke, the O'Neill family home snuggled into the isolated Ozark hills of Missouri. Here dwelt a family raised rich in fantasy and art, music and dreaming. An Irish father, William Patrick O'Neill, with leprechaun leanings, had finally settled down in the brook-edged, tangled wilderness with his artistic, musical family. Here Rose re-



turned periodically for retreat from the demands of her hectic and successful life.

It was during one of these periods that Rose experienced a dream about the little figures described by her in Rowena Godding Ruggles' book, *The One Rose*:

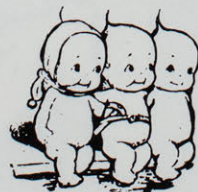
They were bounding about all over the coverlet, chirping their little newborn name. One perched in my hand like a bird... I knew they were elves, but of a new kind. I had a strange impression that their intentions were of the best. In fact, I knew at once they were bursting with kindness, that their hearts were as well-rounded as their tummies. I meditated on them for days afterwards, and bit by bit, I saw they had philosophy.

By December, 1909, drawings of the little elves began to appear. They danced their way through pages of the *Ladies Home Journal*, *Women's Home Companion*, *Delineator*, and *Good Housekeeping*. They "did good deeds in a funny way" in comic strips, calendars, cut-outs and on most everything imaginable. Rose wrote and illustrated over five thousand Kewpie stories for magazines alone.

So beloved did these tiny figures become that letters from children flooded in asking for a Kewpie that they could hold. Touched by their requests, Rose molded a Kewpie. Her high standards for craftsmanship led to the selection of manufacturer J. D. Kestner, Jr., a German firm famous for fine bisque dolls. So intent was she that the Kewpie meet her exacting standards that she traveled to Germany to oversee the initial stages.

The first Kewpies were known as 'straight,' standing stiff-legged, arms outstretched at their sides while the exact playful expression was assured by the artist's supervision.

The first bisque Kewpies from Germany arrived in America December, 1912. Immediate popularity was the result. By January 1913 two European factories were making Kewpies. The following January twenty-one European factories were involved in the manufacture of bisque, cel-



luloid and composition Kewps. These were produced in sizes from two to fourteen inches.

Joseph J. Kallus, founder of Cameo Doll Products and close friend of Rose O'Neill, added the Kewpie to his doll line in 1914 and claimed that by 1915 his plant was working twenty-four hours a day, making only Kewpies.

In addition many other companies in the United States and Japan offered the dolls in plaster, celluloid and rubber.

Definitive proof of the Kewpie's complete acceptance was that the dot used for their eyebrows was the inspiration for the new fad of eyebrow plucking.

Not content with 'straight' Kewpies alone and delighted by the magazine drawings of Kewpies in action, the public demanded 'action' Kewpies. Again Rose O'Neill responded. She began to sculpt such little figures as The Thinker, Kewpie Farmer, Blunderboo, Cook, Army, Careful of His Voice, The Sweethearts, and Always Wears His Overshoes. These were first made in bisque in Germany. As early as 1913 other action Kewpies began to appear in woodpulp and plaster.

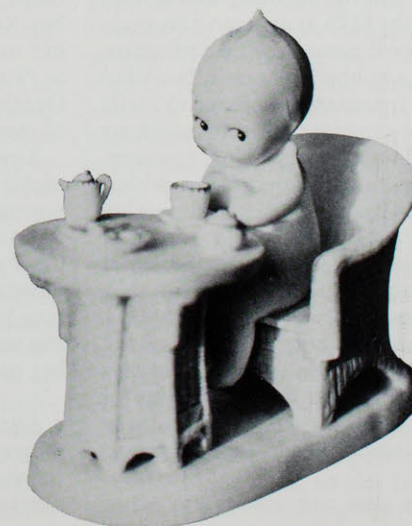
World War I interrupted the making of German-produced Kewpies. The last load of bisque was on its way to the United States when it was torpedoed by a British warship and hundreds of Kewpies sank below the cold Atlantic.

By this time the Kewpie craze had infected the world. According to Kewpie historians Barbara Abernathy and Mary H. Trimble, there was scarcely a country in the world in which you could not find Kewpie dolls displayed. "In Italy, in the shadow of St. Peter's, they divided the shop windows with the holy statues. In Finland, in Kamchatka, they pushed their popular way. There were Japanese Kewpies, Hawaiian Kewpies, Hottentot Kewpies, Kewpies of all sizes and descriptions."

The craze escalated. Licensed manufacturers produced named-action Kewpies replete with molded accessories such as bud vases, place-card plaques, ink wells, pen holders and salt and pepper shakers.

Toy manufacturers were reaping a harvest with tiny pianos decorated with Kewpies, rattles and castile soap in the shape of 'action' Kewps, coloring and paper doll books. And because that gentle era did not feature wholesale mayhem for children's viewing, the magic lantern supplied amusement in the form of Kewpie slides.

Over the years many countries produced Kewpie-decorated china including Germany, Bavaria and Czechoslovakia. The Royal Rudolstadt potters in Prussia coupled their famous quality ware with 'action' Kewpie designs on a variety of vases, baskets, and containers. Lucky little ones might receive baby dishes or children's tea sets displaying the Royal Rudolstadt signature. Grownups could



The Ladies' Home Journal for February, 1916

The First Kewpie Banquet
For once The Kewpies have a few minutes to themselves, and the Jell-O Girl, knowing from long association with them what they like best to eat, is serving Cherry Jell-O.

As the wise little Kewpies seem to be always right, you who share their preference for dainty Jell-O desserts will be delighted to know that a splendid new Jell-O book has just been printed and that all you have to do to get a copy of it is to write and ask us for it. There are recipes for fine new Jell-O salads as well as new Jell-O desserts in this splendid book and we hope you will send for it without delay. Strawberry, Raspberry, Lemon, Orange, Cherry, Peach, Chocolate are the seven flavors in which Jell-O is made.

SEE PURE FOOD CO.
Chicago, Ill.

content themselves with adult-sized tea sets, pin trays, perfume bottles, powder jars or hatpin holders.

Computers have not calculated the possible amount of lumber utilized in the production of Kewpie paper products, but human ingenuity missed few opportunities to Kewpieize any possible surface. Notepapers, stationery, notebooks, albums, party invitations, greeting cards, Christmas cards, post cards, playing cards were all manufactured and sold by the hundreds of thousands. There were the popular paper transfers, the transfer patterns for tea towels, china, pillow tops, chair backs, dresser scarves. An enterprising tobacco concern gave away squares of flannel decorated with Kewps in action. These squares were in great demand for fashioning into pillow tops for use on porches and in the ever-popular canoe.

Not to be bypassed, fabric manufacturers issued materials with Kewpies riding on the backs of birds or dragonflies and others scampering pell-mell over the entire surface.

Ever ready to snap up a trend, jewelry manufacturers released a flood of silver and gold-plated pins, earrings, bracelets, hatpins, stickpins and bib clips — all featuring the beloved Kewpie.

Crushing into the bandwagon already jammed with manufacturers gleaning Kewpie dollars was a United States foundry which obtained from Rose O'Neill permission to use her Kewpies in casting metal novelties. Consequently the public was treated to a selection of Kewpie metal lamps, door knockers, inkwells, candlesticks and radiator caps. Although the foundry's contribution lacked the delicacy of bisque and other more refined materials, it unknowingly produced items which are a boon to today's collectors.

Christmas trees were decorated with Kewpie lights and tree ornaments, under which it was hoped a Kewpie-conscious Santa would add to the proliferation of little elf items.

According to the research of June Anderson, President of the International Rose O'Neill Club, sixty-six different O'Neill illustrations for Jell-O products appeared from October 1908 through May 1921. These were found in twenty-seven different named publications. The Kewps also enhanced a number of Jell-O advertising booklets.

While the Kewpie craze seems to have gradually abated, the Kewpie in various forms is still produced in the United States and Japan. Certain replicas are of high and enduring quality. Others are not.

Prices, however, have not abated. In 1913, the year the doll first appeared, a four-and-a-half inch tall version cost 25¢. Today, an authentic Kewpie that size would cost close to \$100.

Pages from McClurg's 1915-1916 Catalogue show bisque and celluloid Kewpies. The 'straight' seven-and-one-

The Flying Kewpies

A New and Fascinating Kewpish Family

By Rose O'Neill



WOMAN'S HOME COMPANION,
May, 1913. 1973 reprint by
Loraine Burdick.

TO MAKE the Flying Kewpies, first cut out both back and front views carefully. Just before you paste the back and front together, place the end of a string between the front and the back of the head. Put a slight weight on the Kewpie to keep him flat, and when he is dry you can hang him up by his string from the chandelier, and play he is flying

half inch bisque, "boxed with picture label and poetic verse" was offered at \$1.00. Today \$150 might fetch the same doll, without box, label or verse.

Two small 'action' kewpies, The Hugers, dressed in original bride and groom outfits, brought \$175 at auction this year.

At the present time Kewpie collection is more than a hobby. It is a cult. Founded in 1967, the International Rose O'Neill Club now has ten state affiliates and four national. Each spring the Club sponsors Kewpiesta, an unparalleled event which takes place in Branson, Missouri, twelve miles from the O'Neill family homesite of Bonniebrook. Speaking from personal experience, this author can state that when one goes to Kewpiesta one enters a different world. For here the spirit of the Kewpie infiltrates the area and infuses the participants with the philosophy of the Kewpie: love, kindness, playfulness ... a world untroubled by platitudes or prejudices.

In Branson one can also view other

works of Rose O'Neill. No charismatic Kewpies wing their frolicsome way into her "Sweet Monster" paintings, those pagan and mystical depictions of satyrs, dryads, fauns and centaurs which astonished the art world when first displayed. No Kewpies perch on the shoulders of her monumental sculptured pieces such as "Embrace of the Tree" and "The Love Death," described as great twisted things of stone.

Kewpies were scarcely the reigning motif in the life-style of this uncommon woman.

And yet — "There's no denying I'm madly in love with the little elf." These words written by Rose O'Neill in referring to her irresistible creation, describe the sentiments of millions who remember, own, or collect the Kewpie.

Elizabeth J. Wright is herself a "Kewpie person." She has written for radio, television, national magazines, and serves on TERRA's Editorial Board.



Architectural emphasis and elaboration are provided by simple variations in the massive structure of the church of San Lorenzo at Picuris Pueblo.

ADOBE!

by ROBERT NICOLAIS

Photographs by the author except where noted.

Think about adobe buildings and what comes to mind? Most likely it is some picture of a dusty street lined with crumbling houses, or the serene sculpture of a sunwashed Indian pueblo, or maybe even the pinnacles and buttresses of a mud-built mosque in the Sahara. If you ask someone involved with architecture or construction about adobe you might hear some polite noises about quaint and primitive building techniques. But a growing number of people believe that adobe construction is not only a particularly interesting way of building but that it also has some special advantages which are important in an energy conscious world.

The word adobe comes to us from the Spanish, but, like many Spanish construction terms, it in turn is derived from Arabic. The word adobe is now used to refer to mud bricks, the clayey soil from which they are made, or a building made from adobe.

Adobe has a long and fascinating history. Its use undoubtedly goes far back into prehistory; and in many of the early civilizations of the Middle East and Mediterranean it was as commonly used as wood frame construction is now in Southern California. The Roman architect Vitruvius, writing in the first century A.D., devotes a section of his treatise on architecture to the making of adobe bricks

which were used by the Romans for a variety of purposes.

The sixteenth century Inca chronicler, Garcilaso de la Vega, describes how adobe block was used in temples and palaces as well as ordinary houses in the Inca Empire.

The use of adobe for construction has continued to the present throughout much of the world, including the American Southwest. It has been estimated that, even now, at least one third of the world's population lives in some sort of earthen housing. The practical appeal of adobe construction lies in the material's availability worldwide, and in the fact that its use requires a minimum of technology. The esthetic appeal is more difficult to describe, but the author has succumbed to the gentle visual delights of the thick walls, softened edges, and not-quite-plumb construction often found in rural New Mexican adobe buildings.

Adobe itself is a mixture of clay and other materials, usually sand and silt; but its properties vary with the way it is mixed and used. Clay is one of the commonest soils found. Clay minerals are silicates weathered from abundant silica-bearing rocks by processes of leaching and oxidation. Clay particles are thin flat microcrystals with the ability to hold water loosely between particle layers in a colloid-like state so the particles slip and slide easily. This gives wet clay its

smooth plastic texture and its ability to trap four-wheel drive trucks; and it also accounts for its high rate of shrinkage as the water is driven off and the material dries. Pure clay does not make the strongest adobes because of this shrinkage, so sand and silt are usually added. Adobe makers in New Mexico ordinarily use a mixture of between 15% and 40% clay but a study done at the University of New Mexico in 1950 indicates that a range of 5% to 30% gives the best results, and this study cites National Bureau of Standards testing, which resulted in a recommendation of 19% coarse sand, 42% fine sand, 22% silt, 17% clay and 8% clay colloids for a superior soil for all types of earth construction. Rammed earth construction, in which damp earth is packed solidly between forms yields the densest and strongest earth structures and Mr. R. L. Patty of South Dakota State College reports that the most durable rammed earth wall will contain not more than 20% clay. His tests also indicate that the compressive strength of rammed earth walls increases by up to 40% over a two-year curing period. It is interesting to note that Vitruvius recommends letting adobe bricks cure for approximately two years before use; and Garcilaso de la Vega states that the Incas let bricks cure for two to three years. Current folk technology in New Mexico also maintains that adobes

should be cured for at least a year for best results.

For both bricks, and puddled mud construction in which mud is simply layered up into a wall, a thick or stiff mud mixture yields a stronger and denser material which resists weathering better than a more porous one. Straw is often mixed into adobe of high clay content to prevent it from cracking and the high clay content material sometimes resists weathering better than a sandy material which readily absorbs water through capillary action.

In general, folk technologies have evolved methods of construction that result in low bearing pressures and stresses appropriate to adobe materials. And given protection from ground water and drainage water, sun-dried earth is a solid strong material that is remarkably durable if maintained.

Recently the procedure of adding emulsified asphalt stabilizer to the adobe mixture has become common in the Southwest. This stabilized adobe is water resistant, with a rate of absorption of less than 2% of the material's weight in water being desirable for construction. Adobe blocks and puddled mud can easily be stabilized, but it is harder to stabilize rammed earth because the material is

never so wet as to be a liquid.

Stabilized adobe has a much greater resistance to weathering than natural adobe, but natural adobe will last for centuries if maintained. Much of Taos Pueblo in New Mexico has been standing for at least four hundred years and some parts might date back to the thirteenth century.

Portland cement or lime can be added to a soil to make what is called "soil-crete" but a study done in 1926 at the University of New Mexico indicated that these materials interfered with the cohesive action of the clay and clay colloids and actually reduced the strength of the materials in concentrations of 10% cement or lime. The author attributed this to the presence of free calcium ions and their altering the pH value of the mixture. Tests like this indicate that mud is not as simple a material as it might seem at first thought. This author is not aware of current testing or analysis of adobe materials but it might be the case that stronger adobe materials could easily be produced.

In addition to the historical interest of adobe buildings and the beauty of various building traditions, there is a current interest in earth building generated in part by the all-too-familiar energy crisis.

Adobe has several characteristics which make it attractive to architects and builders interested in passive solar design, as well as those interested in appropriate technology. Adobe has a combination of heat storage capacity and rate of heat conductance that makes it usable for thermal storage mass in passive solar applications. Passive solar technology uses the building itself as the collection, distribution and storage system for heat energy gained directly from the sun's radiation. It is different from an active solar technology which employs specialized collectors and distribution systems to move collected energy to a storage system. A passive system in the pure sense needs no outside source of energy to function, although there are also hybrid systems which use low power fans or pumps to distribute heat energy in a building.

Obviously, energy is available from the sun when it is shining, but it is also obvious that heat is often needed when the sun is not shining. So solar systems need to store collected heat for use at night or on cloudy days. The ability of a building to store a substantial amount of heat or coolness to moderate it through a daily cycle of temperature extremes depends on its thermal storage capability. A thin

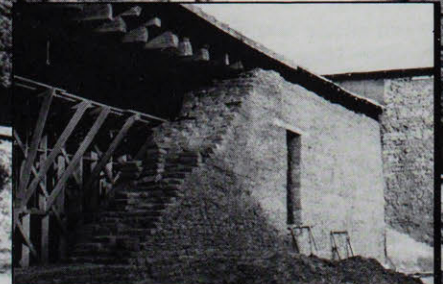
Adobes drying at Southwest Adobe Yard in Tucson, Arizona. Blocks dry lying flat for several days and then are turned up on edge to continue drying.



Adobe skills and technology are easy to learn. Here a participant in an owner/builder workshop in New Mexico mixes mud mortar.



This rammed earth church building is going up in St. David, Arizona. Point shadow lines indicate individual layers of soil that were compacted.



Repair work on this wall shows the massive construction employed in northern New Mexico churches. This is the church of San Juan Nepomuceno in El Rito, built c. 1832.

sheet of black copper placed in the sun heats up very quickly and it also cools down very quickly when the sun sets. A dark masonry wall heats up too, but it stores part of the energy it receives in its mass so it will stay warm for a while after the sun sets.

A building can store enough heat to carry it through a cold night or enough coolness to carry it through a hot day, and thus significantly moderate its extra heating or cooling needs, if the materials from which it is constructed have the capacity for storage. Different materials have different abilities to store heat. The specific heat of a material is the amount of energy it takes to raise one pound of it one degree Fahrenheit. Water was used as a benchmark material; one British Thermal Unit, or BTU, is the amount of energy it takes to raise one pound of water one degree Fahrenheit. Thus water was given a specific heat of 1.0.

In building applications it is handier to deal with cubic feet than with pounds. Since there are 62.4 pounds of water per cubic foot, it takes 62.4 BTUs to raise one cubic foot of water one degree Fahrenheit. The cubic foot of water will also give off 62.4 BTUs for each degree it cools down. This is the heat capacity of water. By

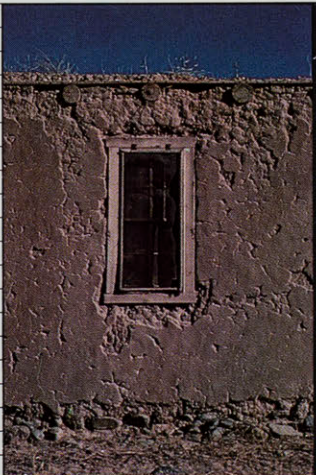
comparison, the heat capacity of steel is 56 BTU/FT³·°F, wood is about 27 BTU/FT³·°F, concrete ranges from 25–35 BTU/FT³·°F depending on its composition. Adobe can store about 22 BTU/FT³·°F, and the heat capacity of air is only .018 BTU/FT³·°F.

All these materials could theoretically be used to store heat. Air is impractical on a residential scale because of the enormous volume that would be required, though it serves quite well on a global scale. Wood presents another problem which is not so obvious. It has a slow rate of conductance and it takes too long to store or recover the 27 BTU/FT³·°F that it can hold to be useful in the twenty-four hour daily cycle we are considering. Water, steel, concrete, brick and adobe have all been used successfully for thermal storage mass. Adobe's rate of conduction is about .30 BTU/FT²·°F·HR; brick's, about .42 BTU/FT²·°F·HR; and concrete's, about 1.0 BTU/FT²·°F·HR. These rates of conduction give a useful transfer of heat in and out of a wall in a twenty-four hour period. Actually, using water in containers or other materials with higher rates of conduction and storage than adobe will result in lower temperature swings with smaller storage mass requirements. But

adobe does perform well as storage mass if there is enough surface area of it exposed; and it has another characteristic which may make it the preferred choice for storage mass.

The amount of energy required to use adobe in construction is small, and transportation of material over long distances can be greatly reduced since clay soils are so common. As energy becomes more expensive it becomes necessary to consider how much energy goes into materials and the construction of our buildings, as well as how much energy it takes to heat them. A study made in 1975 showed that a typical institutional building in the midwest required six times its annual energy budget for manufacturing the materials in it and for its construction. The energy used in mining and transporting raw material to mills or factories was not included. A complete life cycle energy cost analysis must consider the energy it takes to build as well as manufacture and transport materials. We must look for low energy content materials as we try to move to an economy relying primarily on renewable energy sources.

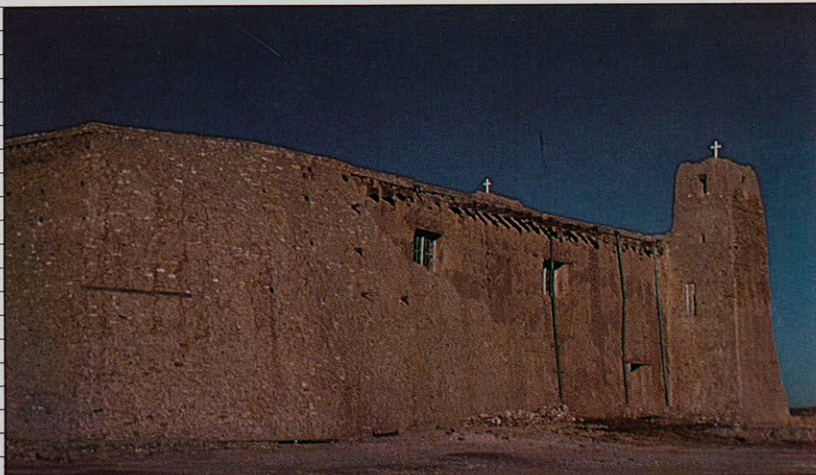
The energy used to manufacture one adobe block has been estimated at 170 BTU. This compares with 15,200 BTU per



This old adobe has a loose stone foundation and a flat earth roof. The mud plaster has probably not been renewed for 15 to 20 years.



Taos Pueblo has been built and rebuilt over a 600 year time span with parts of varying age incorporated into the present structures.



San Estevan at Acoma Pueblo, CA. 1644 is built of stone set in thick mud mortar and adobe block faced with stone.

The whitewashed plaster on the wall of the Caledonia Adobe in San Miguel, CA. 1850, did not bond well to the adobes. Only natural mud plasters seem to form a good bond.



concrete block (8"x8"x16") or 41,000 BTU per pound of aluminum. All materials containing cement are relatively expensive in energy terms as cement production is energy intensive. In 1978, energy costs in cement manufacture represented about 43% of the material cost and about 16% of the total value of shipments.

No one would suggest eliminating the use of cement, but there are some building applications in which adobe may be used instead of either concrete block or wood frame construction with no loss of amenity or serviceability. The large numbers of contemporary adobe houses being built in New Mexico and Arizona show that the material can meet all expectations for comfort and livability. It is very important to realize that small savings on lots of individual projects can result in large savings on a national or worldwide scale.

One of the most important future sources of energy savings will be the utilization of existing sources more efficiently, thus drastically reducing the need for stupendously expensive and potentially lethal technologies, such as nuclear power generation. An important component of efficient utilization of resources is the process of choosing the least costly course. This simply has not been done in the building field in this country in an energy context; and the design and building professions have become accustomed to ignoring the energy consequences of design decisions. Given the fact that clay soils are found almost everywhere, and given current sophistication in stabiliza-

tion methods, adobe can easily fit in to our construction industry.

There are many ways to build with adobe; the commonest is to use bricks. The standard sizes in California and Arizona are similar to concrete block sizes, i.e., 4"x4"x16" or 8"x4"x16", while in New Mexico the standard is 10"x4"x14". In old buildings one finds a great variety in brick size. Since the builder usually made his bricks on site, personal preference was the single greatest factor with the trade-off being between size and weight. In New Mexico walls were often thick, 12" or 18" were common, and in churches walls four or five feet thick were not unusual. Building technology was simple; the massive walls supported heavy horizontal beams. Arches were seldom used because adobe is not very strong in compression. Adobe arches can be built and are found in many parts of the world, but the spans employed must be kept small, in the neighborhood of ten feet.

Early Spanish buildings usually had flat roofs covered with a layer of earth about 12" thick, similar to early California houses, but without the "brea" or tar roofing used here. Adobe was used because it was readily available and cheap, and the region was remote and relatively poor. But these constraints led to the development of a regional style that was well-adapted to the climate and attractive and pleasing enough to lead to a Pueblo revival style in the 1920s and 1930s in the Southwest.

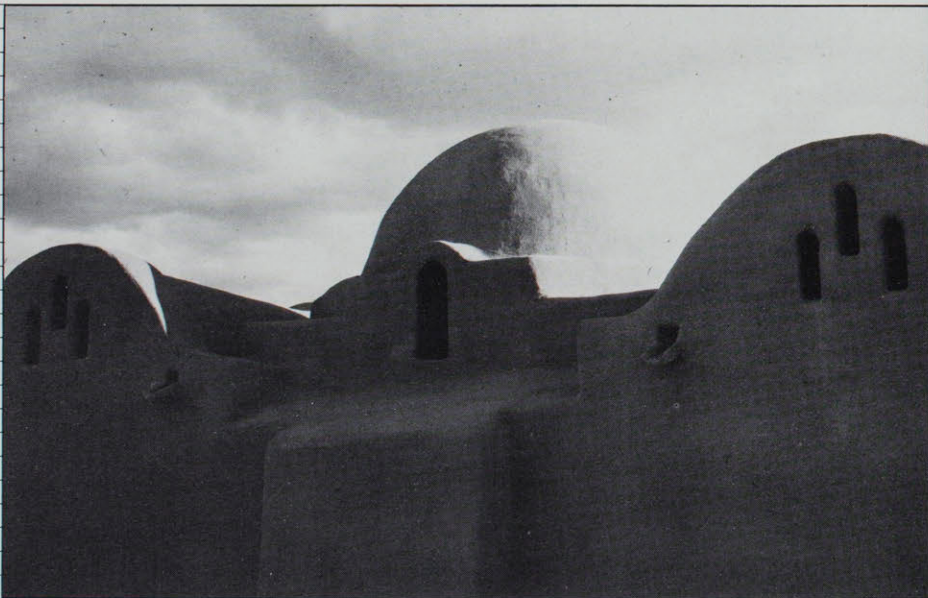
Now much new construction in New Mexico is done in a homogenized con-

temporary style utilizing imported raw materials. However, the tradition of adobe construction never died out, and it is becoming quite popular once again. The situation in Arizona was similar; in the southern part of the state adobe construction all but disappeared but it is now being revived.

There are two other building techniques that were commonly used in the Southwest. The Spanish often built structures with a vertical row of juniper or pine posts, like a palisade, set into a horizontal trough carved of juniper. The wood was covered with thick coatings of mud on each side until the wall was about 12" thick. This is called *jacal* construction in New Mexico, though the word generally means "Indian hut or shed" in Spanish and is derived from *xacalli*, the *Nahuatl* word for reed house. It was a quick and efficient way of building and was commonly used in prehispanic times too.

The technique many of the Rio Grande Pueblos used before the Spanish arrived is called puddled construction. Layers of stiff mud were piled up without the use of forms and the surface was smoothed by hand. This works well in a semi-arid climate where the layers will dry fairly quickly. Puddled construction is also common in North Africa and the Middle East and is often done with great esthetic refinement.

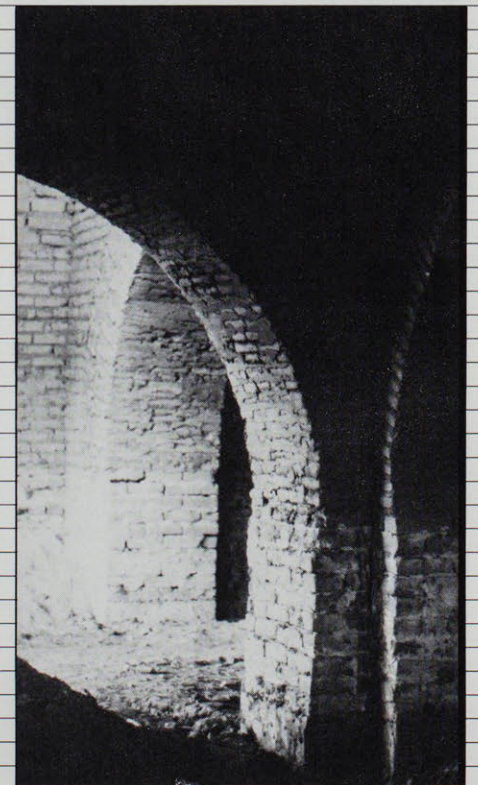
It is interesting to note that Third World countries have high real costs for energy and their native building techniques are usually geared to owner/builders and minimizing expensive technology. But



Above: These vaults and domes at the Dar al Islam Mosque in Abiquiu, New Mexico, show forms typical of Egyptian rural architecture.

Right: The voussoirs of these adobe arches are a thinner adobe block than those used for the piers from which they spring.

Page 27: These heavy arches made up of thin adobes, at the Dar al Islam Mosque in Abiquiu, New Mexico, have no counterpart in New Mexican adobe building traditions.



industrialized construction techniques are often favored because they represent an image of progress. This "image" factor has often led to a bias against adobe construction in the southwest United States, as well as in other countries.

In the wood-poor Middle East, adobe vaults, domes and arches are used over small spans to enclose space, and different sized adobe blocks are used for specialized construction. An Egyptian style adobe building has recently been built in Abiquiu, New Mexico for use as a mosque by a Moslem group. The mosque was designed by Dr. Hassan Fathy, a well-known Egyptian architect and author of *Architecture for the Poor*. The building uses Egyptian sizes of adobe blocks which were made by a local adobe yard. Construction was supervised by Dr. Fathy and led by two skilled Nubian masons. The design incorporates arches, and barrel vaults and domes constructed without forms in the Egyptian manner. It will be interesting to see whether any of this new adobe technology finds its way into rural New Mexican building traditions.

Another ancient technique which may become much commoner in the future is building with rammed earth. Pliny the Younger, another first century A.D. Roman describes how Hannibal and the Carthaginians built rammed earth ramparts and watchtowers in Spain and he remarks on their durability and strength after several hundred years time. To make rammed earth, a sandy soil is dampened to the point where it has the water content allowing maximum com-

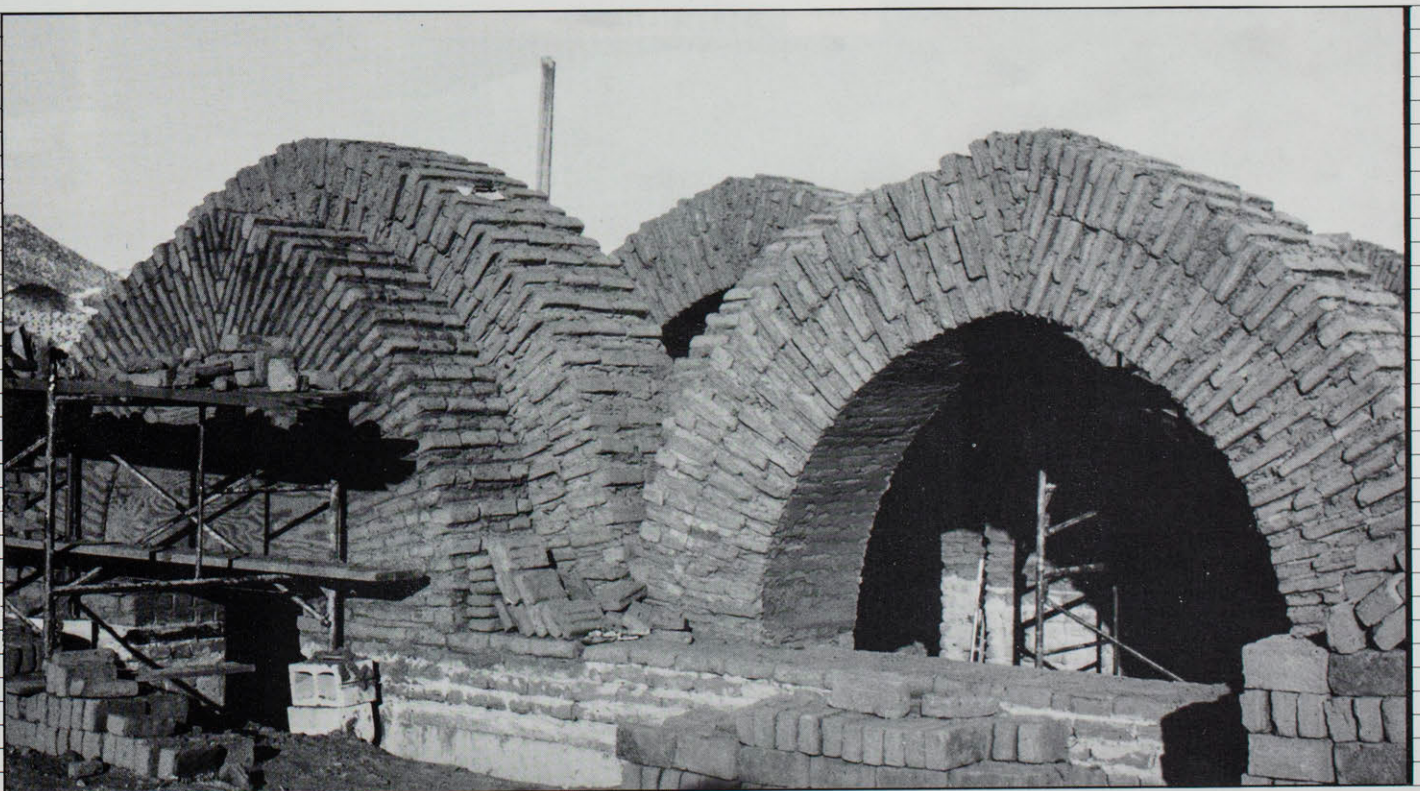
paction. More water than this only forces the soil particles apart, making a less dense but more plastic material. This damp earth is placed in sturdy forms in layers about four inches thick and compacted with a force of approximately 30 p.s.i. The resulting wall has a high thermal mass, is extremely durable, and requires very little energy for its production. A conventional adobe brick wall may require moving the mass in the wall five or six times by hand during the mixing, forming, drying, stacking and laying of the bricks. Using rammed earth, it may be possible to move the mass just once. Currently only a few builders and researchers are exploring rammed earth as a commercially viable construction technique but it may well become the most cost effective way to use adobe. Rammed earth has been used in the south of France and the Middle East for centuries and the British did considerable research on the material during World War II when cement was in short supply. It was also studied in the United States during the Depression as a low cost rural building alternative.

In spite of all the advantages to earth construction it is more difficult to use it safely in California than in other areas. Here, the building codes properly prohibit the use of unreinforced masonry construction because of seismic considerations. Earthquakes produce sharp horizontal accelerations that can literally move a foundation from under a high inertial mass earth wall and rupture it, and repeated shocks can shake apart ma-

sonry walls. Adobe cannot be reinforced as simply as concrete because the lower strength adobe will not grip a reinforcing bar tightly as will concrete. Adobe and earth construction can be adequately reinforced but in a sense this is fighting the nature of the material. The simplest solution is to use adobe thermal mass in a safe non-structural way. One approach is to use a post and beam structural system and then fill in the spaces with adobe. The structural frame is engineered to withstand earthquake shocks by itself. This is a contemporary version of European half-timbered construction.

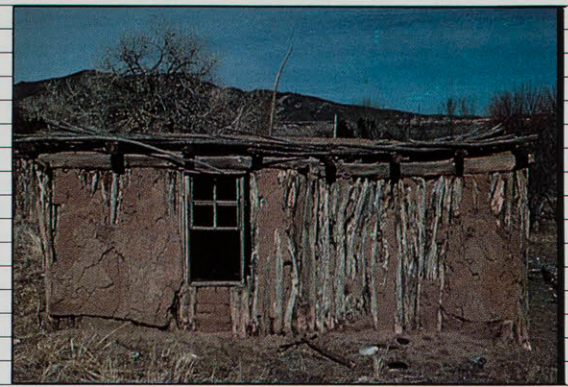
Another approach is to use adobe as a veneer on the inside of a structural frame wall and insulate the exterior side. In the twenty-four hour cycle of temperature swings in a passive solar house, only the first four to six inches of masonry mass participates. Thus a four inch or six inch interior veneer is a safe way of getting thermal mass.

The California Energy Conservation Code requires a thermal storage capability of 30 BTU/°F change in temperature within three feet of each square foot of glazing that is to be considered collector area in a passive system. Researchers at Los Alamos Scientific Laboratory's Solar Division have estimated that storage mass outside of the immediate solar zone of a passive system is about one quarter as effective as mass that is directly affected and they recommend as a rule of thumb, a capacity of 42 BTU/°F for storage in a direct gain system expected to provide about 70% solar savings. So a system of





This gateway at San José shows forms typical of New Mexican adobe architecture.

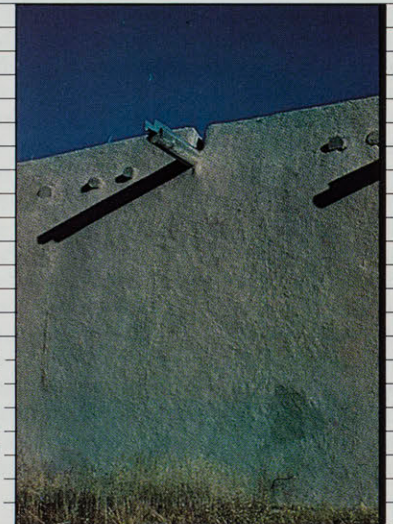


The vertical sticks and top log channel can be seen on this deteriorating jacal House in New Mexico.

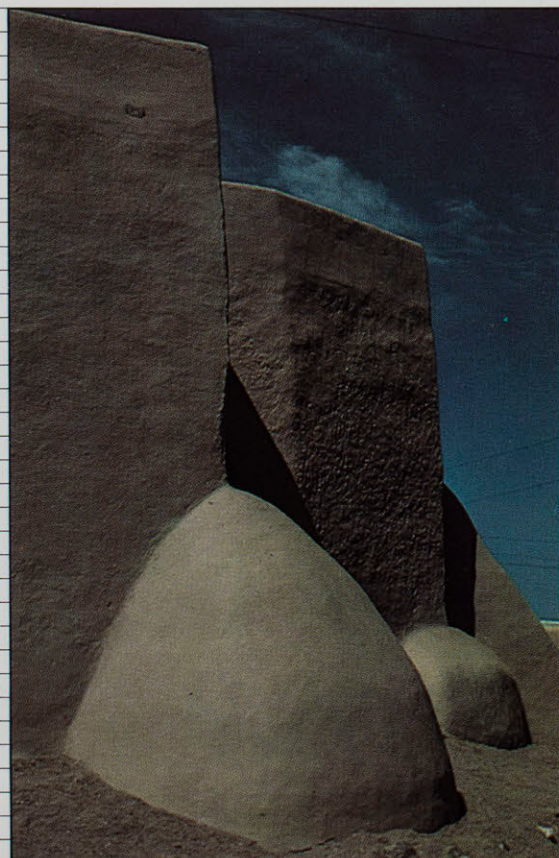


The plain masses of adobe buildings combine easily with other architectural elements like this Territorial Style doorway at San Francisco, Rancho de Taos.

The long canales or drain spouts carry water away from this mud plastered wall at the church of San José de Gracia at Las Trampas, New Mexico. This mud plaster is renewed every two or three years. Straw has been added to this plaster.



These buttresses at San Francisco are ad hoc adjustments to the building necessitated by walls settling or shifting on the stone foundations. This picture was taken when the building still had a cement stucco coating which was hiding damage being done to the adobes by trapped moisture. Natural mud plaster "breathes" with the wall and prevents moisture build-up.

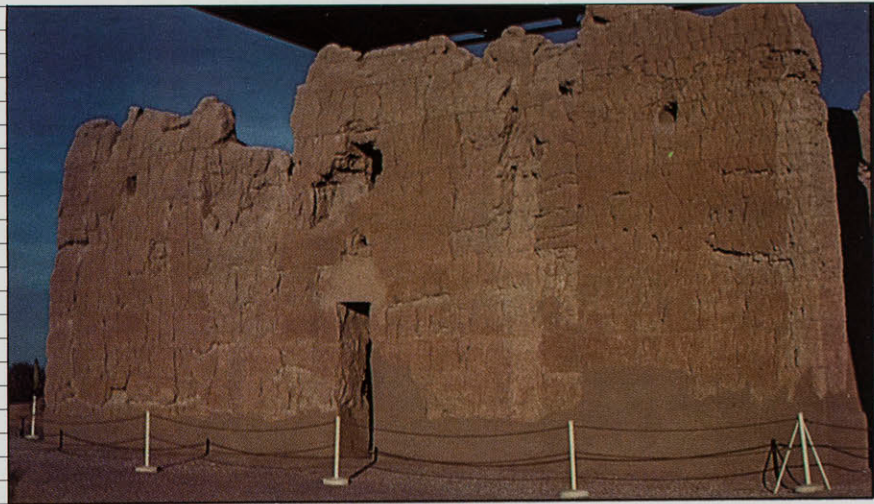


This doorway at Mission San Juan Bautista shows the stronger influence of Spanish Colonial architectural style in the California missions.



This reconstructed building at Mission La Purisima Concepcion has a gypsum plaster coat over the adobes.

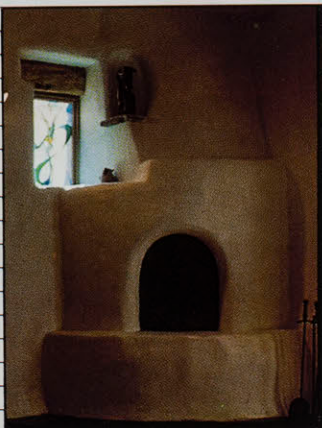
These puddled earth walls at Casa Grande ruin in Arizona show horizontal traces of the layers in which the mud was placed over 600 years ago.



This New Mexico passive solar adobe home uses adobe, brick and water in drums for thermal storage mass. (Karen Terry House: Photo: New Mexico Solar Energy Association)



This contemporary fireplace has been cement plastered and stuccoed. (Photo: Southwest Adobe Co., Tucson, Ariz.)



Adobe construction contributes to the warmth and character of this contemporary Arizona adobe home. (Photo: Southwest Adobe Co., Tucson, Ariz.)

adobe veneers distributed at a rate of about 120 BTU/°F to 160 BTU/°F capacity for each square foot of solar window might be appropriate. A little quick figuring shows each square foot of six-inch thick veneer to have a storage capability of only 11 BTU/°F (½ a cubic foot). If we assume a massive floor slab in the solar zone with a capacity of 10 BTU/°F and some adobe in the solar zone we might be left needing eight to ten times the surface area of the south facing windows distributed throughout the rest of the house, for a first rough estimate. This much mass would certainly damp the extremes of the cycles of temperature swings regardless of what heat source is used. However, common building practice is to put masonry veneers on the outside of buildings where they can be seen but where their potential usefulness as thermal mass is entirely wasted.

For any solar design, one of the most effective strategies is to build a low cost heavily insulated envelope with thermal mass distributed inside in locations and at rates appropriate to the climate being considered. Non-structural interior mass walls can be made of adobe bricks, rammed earth, or even puddled mud; and these walls can easily provide sufficient thermal mass for high solar savings on heating bills in a mild climate such as

that of Southern California, if combined with proper solar design and construction standards. The important thing to remember is that passive solar, high mass design is a subtle integrated technology and there is no universal design solution that can be applied anywhere and everywhere.

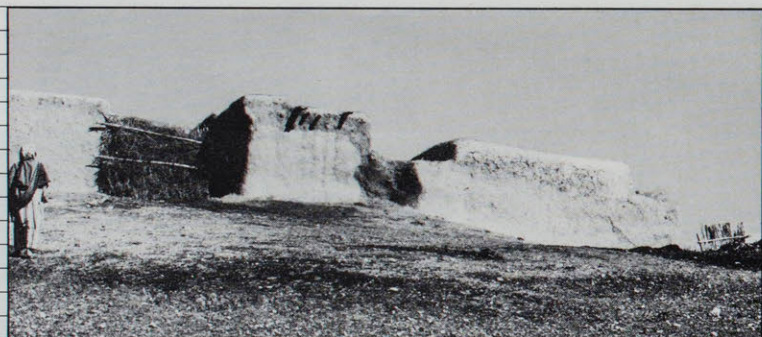
So in conclusion it can be seen that the lowly adobe house deserves serious consideration as a tool of appropriate technology. It is far from a simple material both in its composition and in its thermal behavior, but to some of us this adds to its obvious esthetic qualities. Some of the oldest construction techniques are still useful today, and some newer ways of using adobe show considerable promise for the future. Augustus Caesar boasted of finding Rome a city of brick (some of it certainly mud) and leaving it a city of marble. Our modern Augusti of the building professions could profitably reverse this course and look at how to nudge our aluminum, concrete and petrochemical Rome back to a sensible use of solid earth. Perhaps many of our grandchildren will live in some solarized twenty-first century version of a mud hut plugged in via home computer terminal to the rest of our global village.

Robert Nicolais is an architect who di-

vides his time between Los Angeles and El Rito, New Mexico. His interest in passive solar architecture in New Mexico introduced him to adobe construction and to the properties of this delightful material. He is currently doing research on early California adobe houses.

Bibliography

1. Clough, Richard H. A Qualitative Comparison of Rammed Earth and Sun-dried Adobe Brick, in University of New Mexico Publications in Engineering, number four. U.N.M. Press, 1950, p. 41, ff.
2. Patty, R. L., "Age-strength Relationship for Rammed Earth" in Engineering News Record, July 9, 1936.
3. Eyre, Thomas T., "The Physical Properties of Adobe Used as a Building Material," in The University of New Mexico Bulletin, Number 263, Engineering Series, Vol. I, No. 3, April 1, 1935, p. 25.
4. Kegel, Robert A., "The Energy Intensity of Building Materials" in Heating/Piping/Air Conditioning, June 1975, p. 37, ff.
5. Mazria, Edward, The Passive Solar Energy Book, Rodale Press, Emmaus, PA, 1979, p. 117.
6. Standard and Poors Industrial Surveys. October 1980.
7. Balcomb, J. D. et al., Passive Solar Design Handbook, Vol. II, Passive Solar Design Analysis DOE/CS-0127/2, Jan. 1980, p. 26.

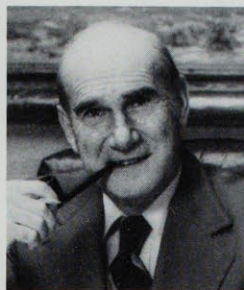


This Moroccan building north of Fez shows many designs and stylistic similarities to Pueblo architecture in the Southwest.

The Mission of San Juan Bautista, founded in 1797, employs both fired brick and adobe block in its construction.



Sciences Division. The staff has been awarded a great many prestigious grants and many have been elected to national boards of directors of science societies by their peers.



Truxal feels that he's moving over to the role of Chief Curator of Life Sciences, emeritus, with much joy. He is going back into research and writing. On a recent trip to South West Africa, South Africa, and Kenya, he found that his enthusiasm, stamina, and knowledge are still undiminished after twenty years as an administrator.

The various Boards of the Museum, the staff, and certainly *TERRA's* editors are all happy and relieved that Truxal will still be around. He has always been a sounding board for both new ideas and old problems, and it's good to know he'll be on hand when we need him.

NEW FOUNDATION OFFICER



Denise Martin has joined the Museum as General Manager of the Natural History Museum Foundation. Formerly Administrative Director of the Los Angeles Children's Museum, Ms. Martin earned her MBA in non-profit management from UCLA, and has an MA in Education from Columbia University. As General Manager of the Foundation, she looks forward to working with the Museum and its Board of Trustees to expand fund raising efforts in the public and private sectors.

ART OF CHARLES R. KNIGHT

The main exhibit of Dinosaurs, Mammoths and Cavemen: The Art of Charles R. Knight is being mounted in the old Rotunda, except for the large LaBrea mural and the *Triceratops* painting (California Fossils Hall) and two cases which will be located in the Museum's main foyer.

NATURAL HISTORY MUSEUM OF LOS ANGELES COUNTY

LEON G. ARNOLD
Acting Director
DR. FRED S. TRUXAL
Acting Assistant Director
DR. JOHN M. HARRIS
Chief Curator, Earth Sciences

DR. ROBERT LAVENBERG
*Acting Chief Curator,
Life Sciences*
DR. HARRY KELSEY
Chief Curator, History

RICHARD LIPSCOMB
Chief of Education
FRANK E. ACKERMAN
Chief of Exhibitions

NATURAL HISTORY MUSEUM OF LOS ANGELES COUNTY—BOARD OF GOVERNORS

Ed N. Harrison
President
Mrs. Justin Dart
Vice President
Richard Call, M.D.
Secretary

Mrs. Jane Boeckmann
Franklin Otis Booth, Jr.
Frederic E. Giersch, Jr.
Albert B. Glickman
Mrs. Robert R. Hollman
Mrs. William F. Hooper

Ivan J. Houston
Richard C. Seaver
Marc A. Seidner
Mynatt Smith
Richard S. Volpert
John G. Wigmore
Dr. M. Norvel Young

NATURAL HISTORY MUSEUM OF LOS ANGELES COUNTY FOUNDATION BOARD

Richard S. Volpert
President
Mrs. Justin Dart
Vice President
Robert P. Miller, Jr.
Vice President
Dr. M. Norvel Young
Secretary
Richard Call, M.D.
Assistant Secretary
Richard C. Seaver
Treasurer
Ed N. Harrison
Assistant Treasurer

Mrs. Denise Martin
General Manager, Foundation
Franklin Otis Booth, Jr.
Lee Bronson
Judge Wm. Matthew Byrne, Jr.
George V. Caldwell
Mrs. Arthur Lee Crowe, Jr.
William W. Drewry, Jr.
Mrs. David Duque
William W. Durney
A. Frederick Gerstell
Albert B. Glickman
David W. Hearst
Ivan J. Houston

Mrs. John Hubbard
Mrs. Max K. Jamison
Dr. Peter Keller
G. Everett Miller
William A. Mingst
Thomas Nickel
George C. Page
Mrs. Donald Rice
Mrs. Richard W. Schuur
Mynatt Smith
Mrs. James Stewart
Mrs. Franz Talley
Mrs. Robert H. Tuttle
Mrs. Hal Wallis
John G. Wigmore

NATURAL HISTORY MUSEUM ALLIANCE BOARD OF DIRECTORS 1981-1982

EXECUTIVE COMMITTEE

William A. Mingst
Chairman of the Board
Mrs. Robert H. Tuttle
First Vice Chairman
Mrs. Leon Singer
Second Vice Chairman
Mrs. James Stewart
Third Vice Chairman
Mrs. David M. Duque
Secretary
A. Frederick Gerstell
At-Large
Mrs. Thomas Reddin
At-Large

ELECTED BOARD

Alexander P. Butterfield
Mrs. Francis L. Dale

Mrs. Michael Dart
Joseph M. Davis, Jr.
Mrs. Suzanne Dragge
Thomas A. Freiberg, Jr.
Judge Ronald M. George
Lewis J. Hastings
Mrs. Kenneth Leventhal
James A. McIntyre
John L. Meek
Mrs. Joseph D. Messler
Mrs. Dan Montano
Mrs. Carlton H. Paul
Mrs. Robert C. Rusack
Mrs. Richard W. Schuur
Mrs. Richard G. Seaver
Dr. John P. Shelton
Mrs. Irving Stone
Harry Tittle
Mrs. Robert J. Wright
James R. Young
John G. Wigmore

HONORARY MEMBERS

Mrs. Robert H. Edwards
Mrs. Robert Feinerman
Mrs. Allan M. Herbert
Mrs. Russel I. Kully
Ernest M. Lever
Robert P. Miller, Jr.

HONORARY LIFE MEMBERS

Dr. Herbert Friedmann
Ed N. Harrison
Mrs. Maurice Machris

EX-OFFICIO BOARD MEMBERS

Mrs. M. L. Brittain III
Harry Pack
Mrs. Charles P. Rosenbaum
Mrs. Ewing Seligman

ADMINISTRATIVE SECRETARY

Mrs. Francis S. Kellough

MUSEUM ALLIANCE MEMBERSHIP

Los Angeles County Museum of Natural History • 900 Exposition Boulevard • Los Angeles, California 90007 • (213) 744-3414
George C. Page Museum • Hancock Park • 5801 Wilshire Boulevard • Los Angeles, California 90036 • (213) 933-7451

Museum privileges and pleasures include:

Free admission for you and your guest or spouse and children (under 18) at both the Natural History Museum and the George C. Page Museum of La Brea Discoveries.

Subscription to *TERRA* Magazine, the Museum Members' Quarterly, one of America's most colorful and informative nature magazines, a national award winner.

TERRA Calendar of Events to keep you current on activities of the Museum.

Discounts at the gift and book shops at both Museums, on ethnic arts, artifacts, curios, books, study guides, etc.

Invitations to preview receptions for new exhibitions, and to the special behind-the-scenes annual open house.

Family programs such as films, lectures, concerts, outings.

Travel program for Alliance members only. Mini-Trips to places like Baja California's ancient art. Big Trips to places like China and the South Pacific.

Alliance Membership dues are tax deductible in accordance with the law.

I wish to apply for membership in the Museum Alliance. I understand my membership card* will admit my immediate family.

Student or	\$15.00 annually
Senior Citizen (62+)	(With I.D.)
Active	\$25.00 annually
Contributing	\$50.00 annually
Patron	\$100.00 annually
Life \$1000	(One payment)
*except student	

Make checks payable to Museum Alliance. Mail to Natural History Museum Alliance, 900 Exposition Blvd., Los Angeles, Ca. 90007. Alliance Information: (213) 749-3631.

IN THE BOOK SHOP*... *DINOSAURS, MAMMOTHS, AND CAVEMEN* *THE ART OF CHARLES R. KNIGHT*

by Sylvia Massey Czerkas and Donald F. Glut



This is the first book about the life and work of artist Charles R. Knight (1874–1953), whose great murals are to be seen at the American Museum of Natural History, the Field Museum in Chicago, and the Los Angeles Natural History Museum. Knight was the first, and undeniably the greatest artist to recreate, with both scientific accuracy and great beauty, creatures and environments of prehistoric eras that no living being had ever experienced firsthand. His work remains unsurpassed to this day. 120 color plates, 39 black and white illustrations, 8½" x 11". For telephone orders, call 744-3434.

Hardcover \$24.75
Softcover \$14.75

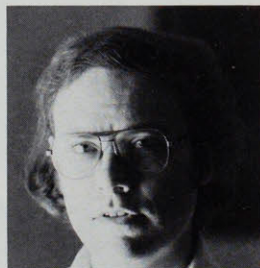
MEET THE AUTHORS!

The fascinating authors of this brand new book will be present to informally discuss and autograph copies.

SATURDAY, MARCH 27, 1982
1:00 P.M., MUSEUM FOYER



SYLVIA MASSEY CZERKAS is a professional artist whose work has been shown throughout the United States. She has been guest curator for special exhibits, she is the founder of "The Dinosaur Society" and she is currently co-producing a film on dinosaurs.



DONALD F. GLUT has been a professional writer since 1966, during which time he has authored more than 30 books, including the novelization of *THE EMPIRE STRIKES BACK*, and such nonfiction books as *THE DINOSAUR DICTIONARY* and *THE DINOSAUR SCRAPBOOK*. Glut has also written numerous short stories, television scripts, comic book scripts, and articles.

**This book is available at both the Los Angeles County Museum of Natural History and the Page Museum.*

THE PAGE MUSEUM SHOP

George C. Page Museum
5801 Wilshire Blvd.
Los Angeles 90036

THE BOOK SHOP

Natural History Museum
900 Exposition Blvd.
Los Angeles 90007